What is claimed is:

1. A device comprising:

   a primary light source; and

   a population of photoluminescent quantum dots (QDs) disposed in a host matrix,

   wherein:

   each QD of the population comprises a core of an independently selected size and composition, and the population comprises a selected size distribution of QDs;

   at least a portion of the QDs have a band gap energy smaller than the energy of at least a portion of the light produced by the light source; and

   the matrix is in optical communication with the light source and is disposed so as to allow the light to pass therethrough, thereby causing the QDs to photoluminesce light of a color characteristic of the size, size distribution, composition, or combination thereof.

2. The device of claim 1, wherein the host matrix is transparent to photoluminescent light emitted by the QDs.

3. The device of claim 1, wherein the host matrix is transparent to light produced by the light source and to photoluminescent light emitted by the QDs.

4. The device of claim 1, wherein the core of each QD comprises a material independently selected from the group consisting of CdS, CdSe, CdTe, ZnS, ZnSe, ZnTe, GaAs, GaP, GaAs, GaSb, HgS, HgSe, HgTe, InAs, InP, InSb, AlAs, AlP, AlSb, alloys thereof, and mixtures thereof.

5. The device of claim 4, wherein the QDs further comprise a core overcoat comprising a material independently selected from the group consisting of ZnO,

ZnS, ZnSe, ZnTe, CdO, CdS, CdSe, CdTe, MgS, MgSe, GaAs, GaN, GaP, GaAs, GaSb, HgO, HgS, HgSe, HgTe, InAs, InN, InP, InSb, AlAs, AlN, AlP, AlSb, alloys thereof, and mixtures thereof.

6. The device of claim 1, wherein the primary light source is in physical contact with the host matrix.

7. The device of claim 1, further comprising a medium interposed between the primary light source and the host matrix.

8. The device of claim 1, wherein the host matrix comprises at least one material selected from the group consisting of liquids, polymers, epoxies, silica glasses, and silica gels.

9. The device of claim 1, wherein the host matrix comprises at least one polymer selected from the group consisting of polyacrylate, polystyrene, polyimide, polyacrylamide, polyethylene, polyvinyl, poly-diacetylene, polyphenylene-vinylene, polypeptide, polysaccharide, polysulfone, polypyrrole, polyimidazole, polythiophene, polyether, epoxies, silica glass, silica gel, siloxane, polyphosphate, hydrogel, agarose, and cellulose.

10. The device of claim 1, wherein the QDs further comprise a core coat comprising a material having an affinity for the host matrix.

11. The device of claim 5, wherein the overcoated core further comprises a coat having an affinity for the host matrix.

12. The device of claim 10, wherein the host matrix comprises a polymer and the coat material comprises a related monomer.

13. The device of claim 1, wherein the primary light source is selected from the group consisting of a light-emitting diode, a laser, an arc lamp and a black-body light source.

14. The device of claim 1, wherein the population of QDs has a size distribution having less than a 10% rms deviation in diameter of the core.

15. A method of producing a light-emitting device, comprising:
   (a) providing a population of quantum dots (QDs), wherein each QD of the population comprises a core of an independently selected size and composition, the population comprises a selected size distribution of QDs, and the QDs have a surface adapted to allow the QDs to be dispersed in a host matrix, and a host matrix;
   (b) dispersing the QDs in the host matrix; and
   (c) illuminating the QDs disposed in the host matrix with a light source that emits light capable of causing the QDs to photoluminesce secondary light.

16. The method of claim 15, wherein step (a) comprises growing the QDs by precipitation from a solution.

17. The method of claim 15, wherein the core comprises a material independently selected from the group consisting of CdS, CdSe, CdTe, ZnS, ZnSe, ZnTe, GaAs, GaP, GaAs, GaSb, HgS, HgSe, HgTe, InAs, InP, InSb, AlAs, AlP, AlSb, alloys thereof, and mixtures thereof.

18. The method of claim 15, wherein step (a) further comprises coating the core with an overcoat.

19. The method of claim 18, wherein the core overcoat comprises a material independently selected from the group consisting of ZnO, ZnS, ZnSe, ZnTe, CdO, CdS, CdSe, CdTe, MgS, MgSe, GaAs, GaN, GaP, GaAs, GaSb, HgO, HgS, HgSe, HgTe, InAs, InN, InP, InSb, AlAs, AlN, AlP, AlSb, alloys thereof, and mixtures thereof.

20. The method of claim 18, wherein the core overcoat is produced by precipitation

from a solution.

21. The method of claim 15, wherein step (a) further comprises coating the QDs with a coat material having an affinity for the host matrix.

22. The method of claim 21, wherein the host matrix comprises a polymer and the coat material comprises a related monomer.

23. The method of claim 15, wherein the host matrix comprises a material selected from the group consisting of liquids, polymers, epoxies, silica glasses, silica gels, and combinations thereof.

24. The method of claim 15, wherein the host matrix comprises a polymer selected from the group consisting of polyacrylate, polystyrene, polyimide, polyacrylamide, polyethylene, polyvinyl, poly-diacetylene, polyphenylene-vinylene, polypeptide, polysaccharide, polysulfone, polypyrrole, polyimidazole, polythiophene, polyether, epoxies, silica glass, silica gel, siloxane, polyphosphate, hydrogel, agarose, and cellulose.

25. The method of claim 15, wherein the light source is selected from the group consisting of a light-emitting diode, a laser, an arc lamp and a black-body light source.

26. The method of claim 15, wherein the population of QDs has a size distribution having less than a 10% rms deviation in diameter of the core.

27. A composition comprising a population of quantum dots (QDs) disposed in a host matrix, wherein each QD of the population comprises a core of an independently selected size and composition and the population comprises a selected size distribution of QDs, and further wherein the QDs are selected to photoluminesce light when QDs in the host matrix are irradiated with light from a primary source whose energy is greater than the energy of at least a portion of the photoluminesced light.

28. The composition of claim 27, wherein the core comprises a material independently selected from the group consisting of CdS, CdSe, CdTe, ZnS, ZnSe, ZnTe, GaAs, GaP, GaAs, GaSb, HgS, HgSe, HgTe, InAs, InP, InSb, AlAs, AlP, AlSb, alloys thereof, and mixtures thereof.

29. The composition of claim 28, wherein the QDs further comprise a core overcoat comprising a material independently selected from the group consisting ZnO, ZnS, ZnSe, ZnTe, CdO, CdS, CdSe, CdTe, MgS, MgSe, GaAs, GaN, GaP, GaAs, GaSb, HgO, HgS, HgSe, HgTe, InAs InN, InP, InSb, AlAs, AlN, AlP, AlSb, alloys thereof, and mixtures thereof.

30. The composition of claim 27, wherein the host matrix comprises a material selected from the group consisting of liquids, polymers, epoxies, a silica glass, a silica gel and a combination thereof.

31. The composition of claim 27, wherein the host matrix comprises a polymer selected from the group consisting of polyacrylate, polystyrene, polyimide, polyacrylamide, polyethylene, polyvinyl, poly-diacetylene, polyphenylene-vinylene, polypeptide, polysaccharide, polysulfone, polypyrrole, polyimidazole, polythiophene, polyether, epoxies, silica glass, silica gel, siloxane, polyphosphate, hydrogel, agarose, and cellulose.

32. The composition of claim 27, wherein the QDs further comprise a core coat comprising a material having an affinity for the host matrix.

33. The composition of claim 29, wherein the overcoated core further comprise a coat comprising a material having an affinity for the host matrix.

34. The composition of claim 32, wherein the host matrix comprises a polymer and the coat material comprises a related monomer.

35. The composition of claim 27, wherein the population of QDs has a size distribution having less than a 10% rms deviation in diameter of the core.

36. A prepolymer composition, comprising:

a precursor material capable of being reacted to form a solid host matrix that allows light to pass therethrough; and

a population of quantum dots (QDs) disposed in the precursor material, wherein each QD of the population comprises a core of an independently selected size and composition, and the population comprises a selected size distribution of QDs.

37. The composition of claim 36, wherein the precursor material is a monomer capable of being reacted to form a polymer.

38. The composition of claim 37, wherein the precursor material comprises a monomer selected from the group consisting of acrylics, imides, acrylamides, ethylenes, vinylenes, diacetylenes, phenylene-vinylenes, peptides, saccharides, sulfones, pyrroles, imidazoles, thiophenes, ethers, epoxides, silanes, phosphates, styrenes, acids, peroxides, anhydrides, amines, and alcohols.

39. The composition of claim 36, wherein the core comprises a material independently selected from the group consisting of CdS, CdSe, CdTe, ZnS, ZnSe, ZnTe, GaAs, GaP, GaAs, GaSb, HgS, HgSe, HgTe, InAs, InP, InSb, AlAs, AlP, AlSb, alloys thereof, and mixtures thereof.

40. The composition of claim 39, wherein the QDs further comprise a core overcoat comprising a material selected from the group consisting of ZnO, ZnS, ZnSe, ZnTe, CdO, CdS, CdSe, CdTe, MgS, MgSe, GaAs, GaN, GaP, GaAs, GaSb, HgO, HgS, HgSe, HgTe, InAs, InN, InP, InSb, AlAs, AlN, AlP, AlSb, alloys thereof, and mixtures thereof.

41. The composition of claim 36, wherein the QDs further comprise a core coat comprising a material having an affinity for the precursor material.

42. The composition of claim 40, wherein the overcoated core further comprises a

coat comprising a material having an affinity for the precursor material.

43. The composition of claim 42, wherein the overcoated core further comprises a coat that is a material that is a related monomer to the polymer formed from the precursor material.

44. The composition of claim 36, wherein the population of QDs has a size distribution having less than a 10% rms deviation in diameter of the core.

45. A method of preparing a device, comprising:

(a) providing a prepolymer composition, comprising

(i) a precursor material capable of being reacted to form a solid host matrix that allows light to pass therethrough, and

(ii) a population of quantum dots (QDs) disposed in the precursor material, wherein each QD of the population comprises a core of an independently selected size and composition, and the population comprises a selected size distribution of QDs,

(b) reacting the precursor material to form the host matrix with QDs dispersed therein; and

(c) providing a primary light source in optical communication with the host matrix with QDs dispersed therein.

46. A method of producing light of a selected color, comprising:

(a) providing a population of quantum dots (QDs), wherein each QD of the population comprises a core of an independently selected size and composition, the population comprises a selected size distribution of QDs, and the QDs have a surface adapted to allow the QDs to be dispersed in a host matrix;

(b) dispersing the QDs in the host matrix; and

(c) illuminating the QDs disposed in the host matrix with primary light of an energy greater than the characteristic band gap energy of at least a portion

of the QDs,

whereby the selected color is photoluminescent light emitted by the QDs, light transmitted from the primary light source through the host matrix or a combination thereof.

47. The method of claim 46, wherein the host matrix allows photoluminescent light emitted by the QDs to pass therethrough.

48. The method of claim 46, wherein the host matrix allows light produced by the light source and photoluminescent light emitted by the QDs to pass therethrough.

49. The method of claim 47, wherein the photoluminescent light emitted by the QDs is detected.

50. The method of claim 48, wherein the photoluminescent light emitted by the QDs is detected.

51. The method of claim 48, wherein both the light produced by the light source and the photoluminescent light emitted by the QDs are detected.

52. The method of claim 46, wherein the light of the selected color is the photoluminescent light emitted by the QD.

53. The method of claim 46, wherein the light of the selected color is the combination of photoluminescent light emitted by the QDs and light transmitted from the primary light source through the host matrix.

54. The method of claim 48, wherein the light of the selected color is the photoluminescent light emitted by the QD.

55. The method of claim 48, wherein the light of the selected color is the combination of photoluminescent light emitted by the QDs and light transmitted from the primary light source through the host matrix.

56. The method of claim 46, wherein the core comprises a material independently selected from the group consisting of CdS, CdSe, CdTe, ZnS, ZnSe, ZnTe, GaAs, GaP, GaAs, GaSb, HgS, HgSe, HgTe, InAs, InP, InSb, AlAs, AlP, AlSb, alloys thereof, and mixtures thereof.

57. The method of claim 46, wherein step (a) further comprises coating the core with an overcoat.

58. The method of claim 57, wherein the core overcoat comprises a material independently selected from the group consisting of ZnO, ZnS, ZnSe, ZnTe, CdO, CdS, CdSe, CdTe, MgS, MgSe, GaAs, GaN, GaP, GaAs, GaSb, HgO, HgS, HgSe, HgTe, InAs, InN, InP, InSb, AlAs, AlN, AlP, AlSb, alloys thereof, and mixtures thereof.

59. The method of claim 57, wherein step (a) further comprises coating the QDs with a coat material having an affinity for the host matrix.

60. The method of claim 57, wherein step (a) further comprises coating the overcoated core with a coat material having an affinity for the host matrix.

61. The method of claim 46, wherein step (a) comprises,

(i) providing a precursor material having QDs disposed therein; and

(ii) reacting the precursor material to form a solid host matrix having QDs disposed therein.

62. The method of claim 46, wherein step (a) comprises,

(i) providing at least two precursor materials, wherein each precursor material has disposed therein a population of QDs having a size, size distribution, composition or combination thereof, selected to be different from that of the population of QDs in any of the other precursor materials,

(ii) combining the precursor materials, and

(iii) reacting the precursor materials to form a solid host matrix having QDs

disposed therein.

63. The method of claim 62, wherein first and second precursor materials are provided, and further wherein the first precursor material has a first population of QDs having a first size, size distribution, composition or combination thereof disposed therein and the second precursor material has a second population of QDs having a second size, size distribution, composition or combination thereof disposed therein.

64. The method of claim 62, wherein step (ii) comprises admixing the precursor materials.

65. The method of claim 46, wherein step (a) comprises,

(i) providing at least two precursor materials, wherein each precursor material has disposed therein a population of QDs having a size, size distribution, composition or combination thereof, selected to be different from that of the population of QDs in any of the other precursor materials,

(ii) forming a layer of a precursor material;

(iii) reacting the layer of precursor material to form a solid host matrix layer having QDs disposed therein; and

(iv) repeating steps (ii) and (iii) on the solid host matrix layer formed in step (iii).

66. The method of claim 65, wherein step (iv) comprises repeating steps (ii) and (iii) with the same precursor material.

67. The method of claim 65, wherein step (iv) comprises repeating steps (ii) and (iii) with a different precursor material.

68. The method of claim 46, wherein the host matrix comprises at least one material selected from the group consisting of polymers, epoxies, silica glasses, and silica gels.

69. The method of claim 46, wherein the host matrix comprises a polymer selected from the group consisting of polyacrylate, polystyrene, polyimide, polyacrylamide, polyethylene, polyvinyl, poly-diacetylene, polyphenylene-vinylene, polypeptide, polysaccharide, polysulfone, polypyrrole, polyimidazole, polythiophene, polyether, epoxies, silica glass, silica gel, siloxane, polyphosphate, hydrogel, agarose, and cellulose.